CITCRYO1-18

Cryogenic HEMT Low Noise Amplifier

KEY FEATURES

- Very low noise, of the order of 7K, over an extremely wide bandwidth, 1 to 18 GHz.
- Operates with wide range of DC supply voltage.
- Provides usable gain and noise at DC power as low as 3 mW.
- Input return loss is <-10 dB.
- Output return loss is <-10 dB, 1 to 18 GHz.

PERFORMANCE FEATURES

- RF frequency
  - 1 to 18 GHz
- Gain
  - 35 dB ± 2 dB
- Noise temperature
  - <7 Kelvin
- Average noise figure
  - <0.10 dB

APPLICATIONS

- ✓ Radio astronomy arrays
- ✓ Satellite and Space Communication
- ✓ Research & development

Description

- The CITCRYO1-18 is a GaAs HEMT cryogenic, low noise, broadband amplifier. The amplifier requires one drain voltage in the 0.6 V to 1.5 V range and one gate voltage in the -3 V to +1 V range through terminals Vg1 and Vg2, each with 11K DC input resistance. See the table on page 5 for performance vs bias voltages. If desired, the gate supply can be eliminated (open circuit pins Vg1 and Vg2) at slightly less than optimum performance.

- The amplifier may be operated at room temperature to give a noise figure <1.70 dB and gain >33 dB from 0.5 to 2 GHz. Note that a more negative gate supply voltage, typically -1.5 V, is required at room temperature. However, the amplifier is not damaged if the gate voltage for cryogenic operation, typically 0 V, is applied at room temperature (though the gain will be low). Input and output return loss change very little from 300K to 4K.

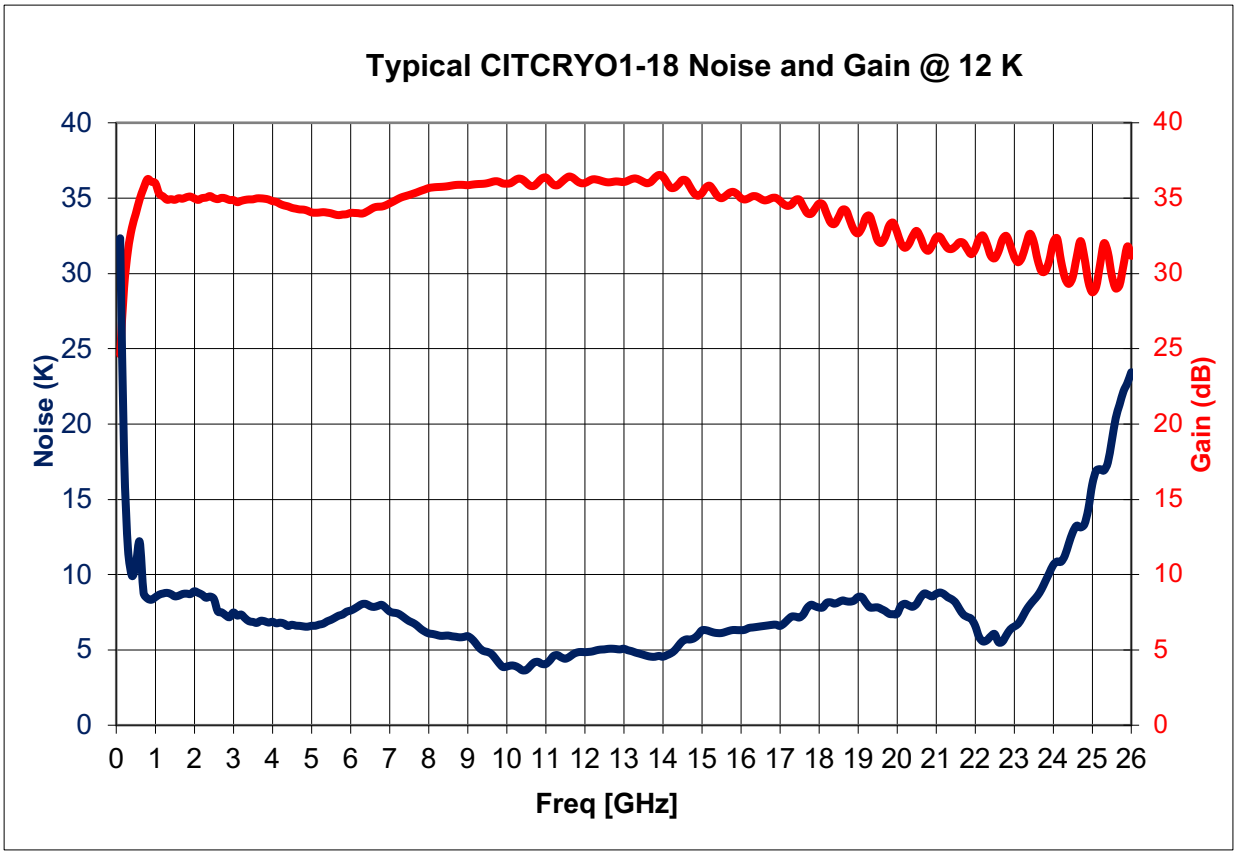
Electrical Specifications @ 12 K

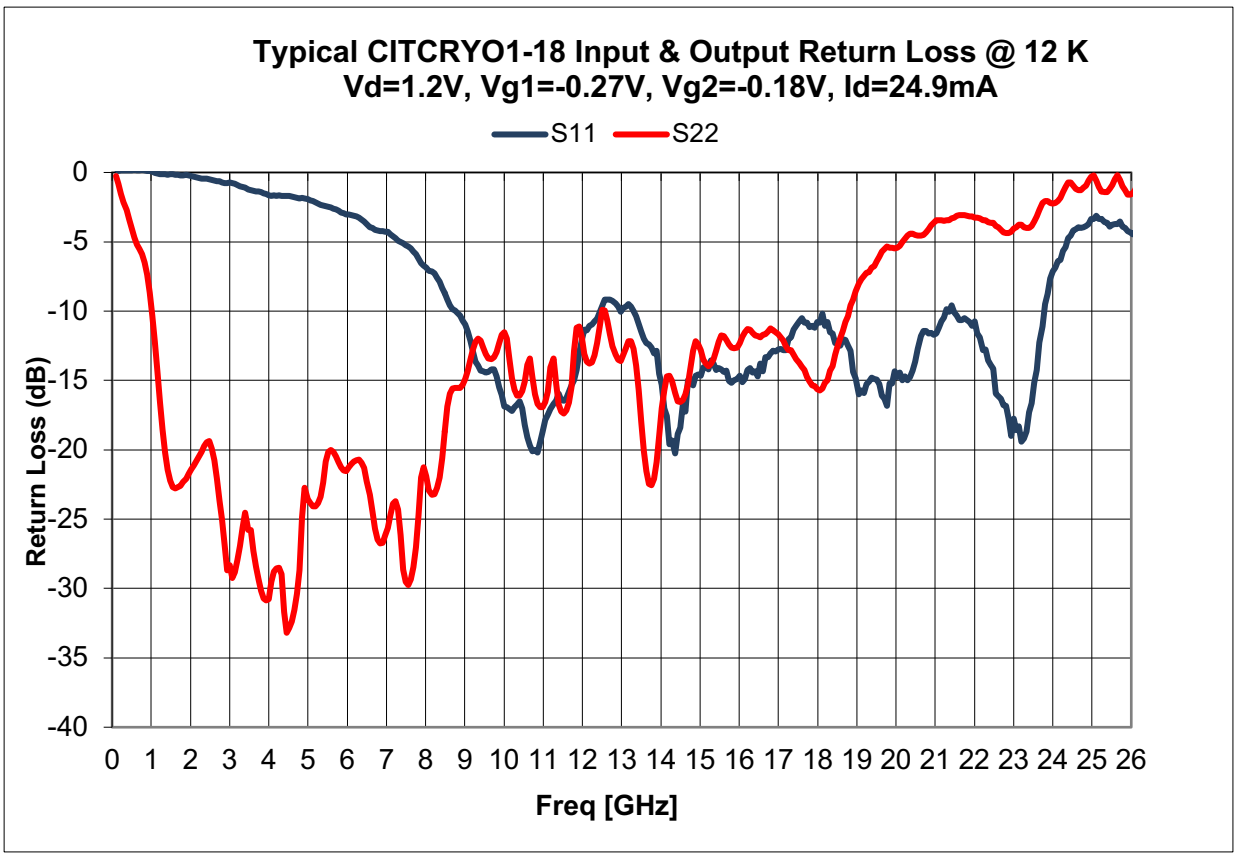
Description	Typical	Minimum	Maximum
RF Frequency		1 GHz	18 GHz
Gain	35 dB	35 dB ± 2 dB	
Noise Temperature	< 7K		
IRL (-20log|S_{11}|)		< -10 dB	
ORL (-20log|S_{22}|)		< -10 dB	
Drain Voltage	1.2 V	0.8 V	1.6 V

Electrical Specifications @ 300 K

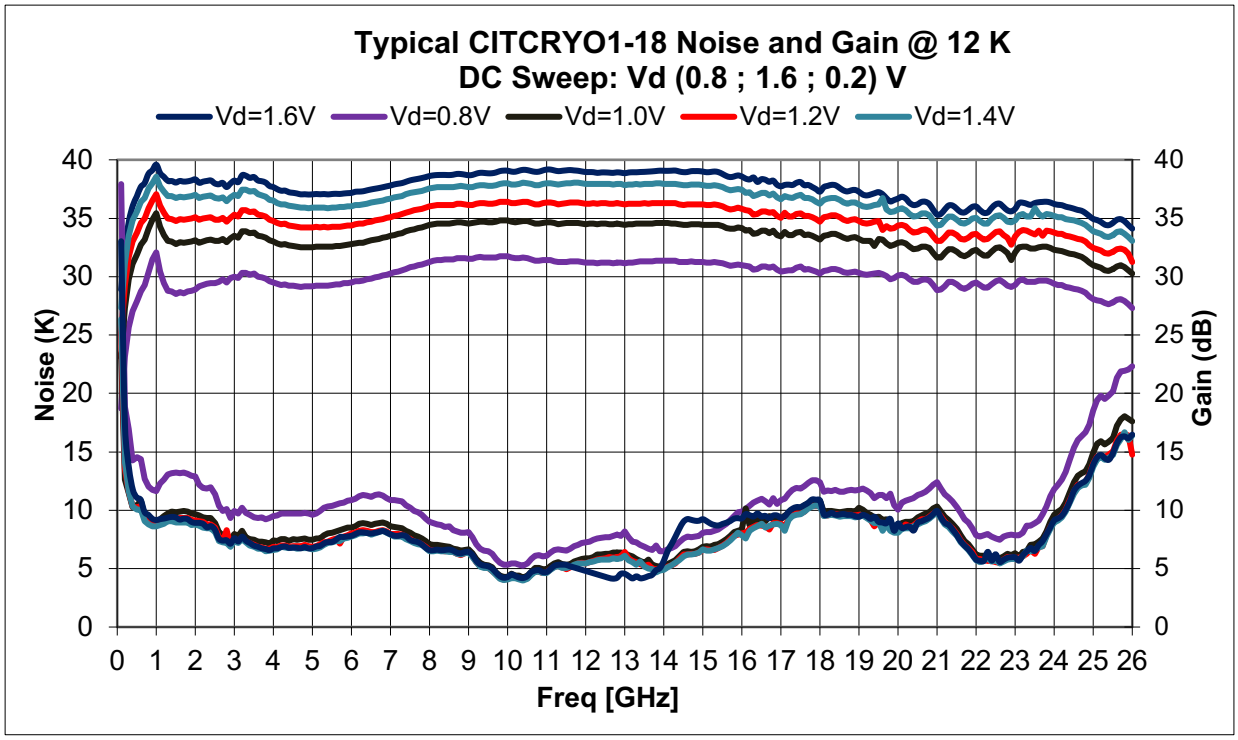
Description	Typical	Minimum	Maximum
RF Frequency		1 GHz	18 GHz
Gain	33 dB	32 dB ± 3 dB	
Noise Temperature	< 100K		
IRL (-20log|S_{11}|)		< -10 dB	
ORL (-20log|S_{22}|)		< -10 dB	
DC Voltage	1.5 V	1.0 V	1.6 V

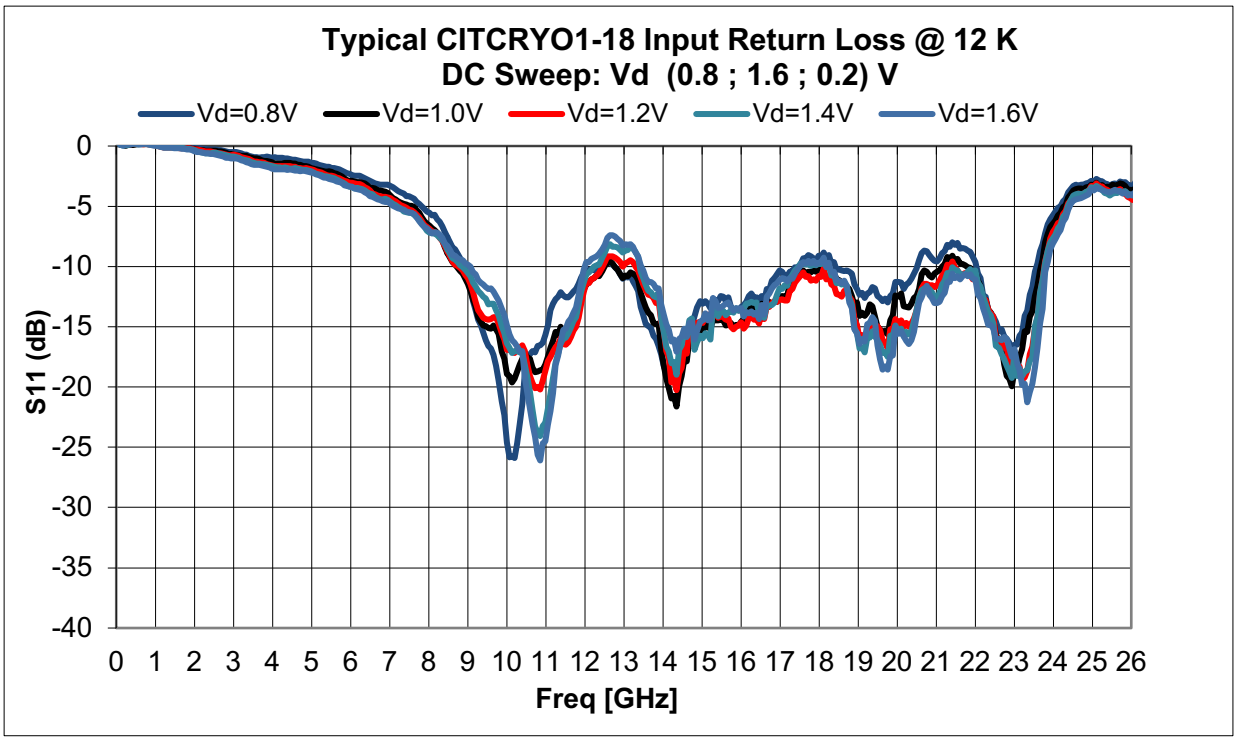
Typical Test Results – Optimum DC Bias @ 12 K





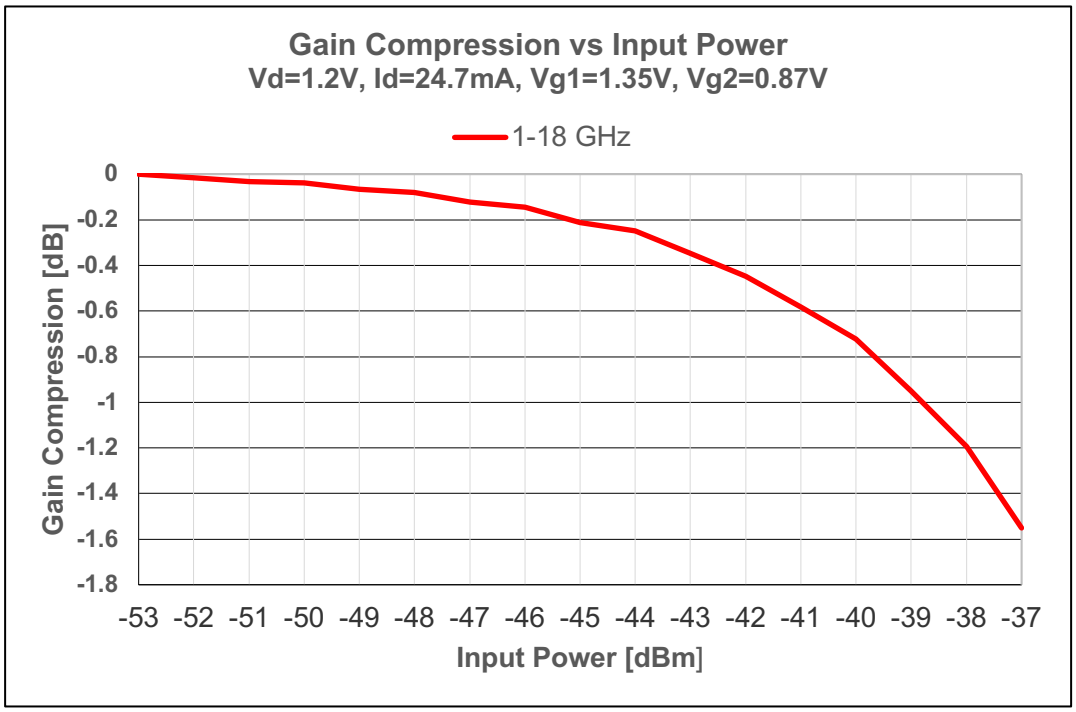
Typical Test Results – DC Bias Sweep @ 12 K

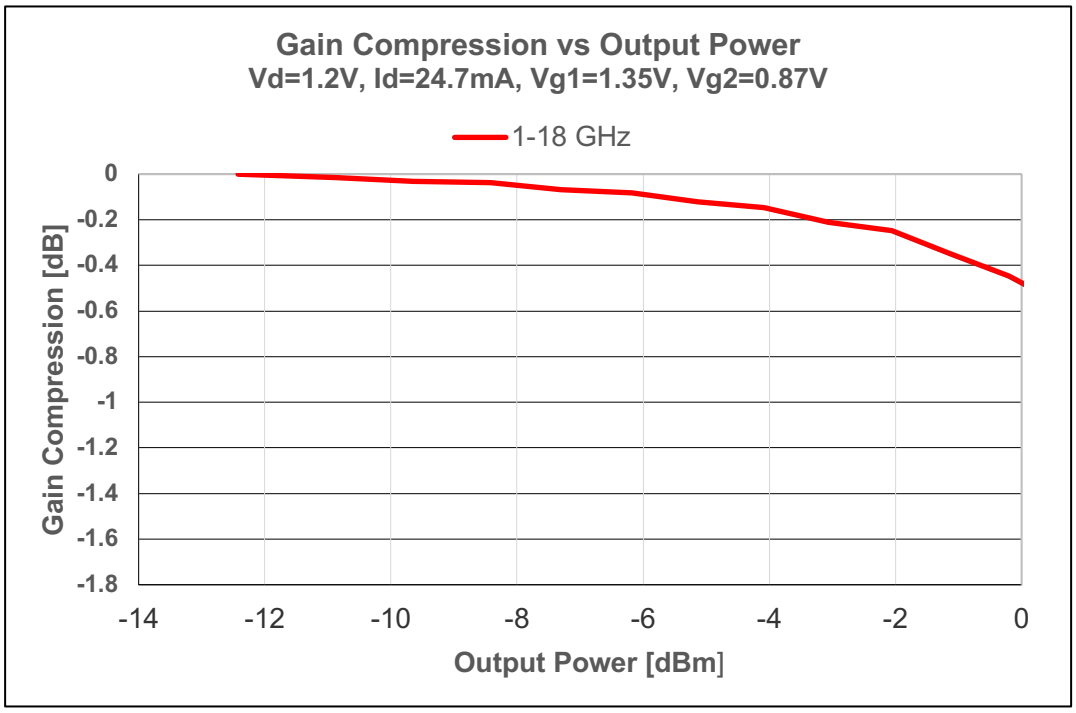


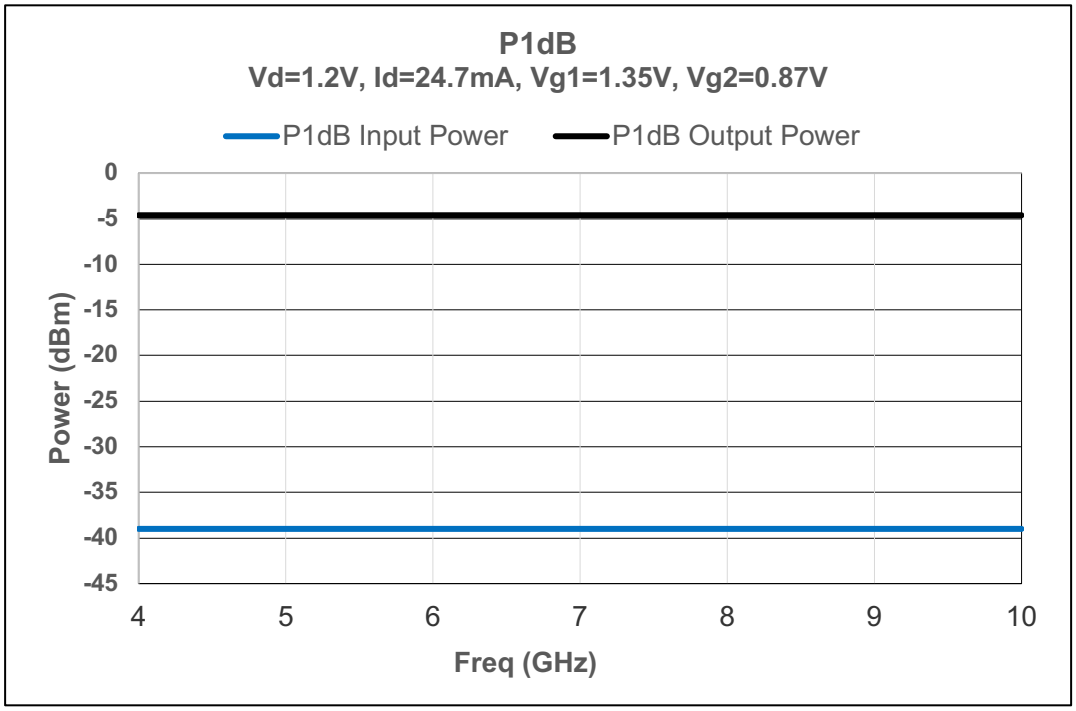


Vd (V)	Vg1 (V)	Vg2 (V)	Id (mA)
0.8	-0.44	-0.23	14.3
1.0	-0.29	-0.14	20.8
1.2	-0.27	-0.18	24.9
1.4	-0.22	-0.08	31.9
1.6	-0.24	0.00	38.3

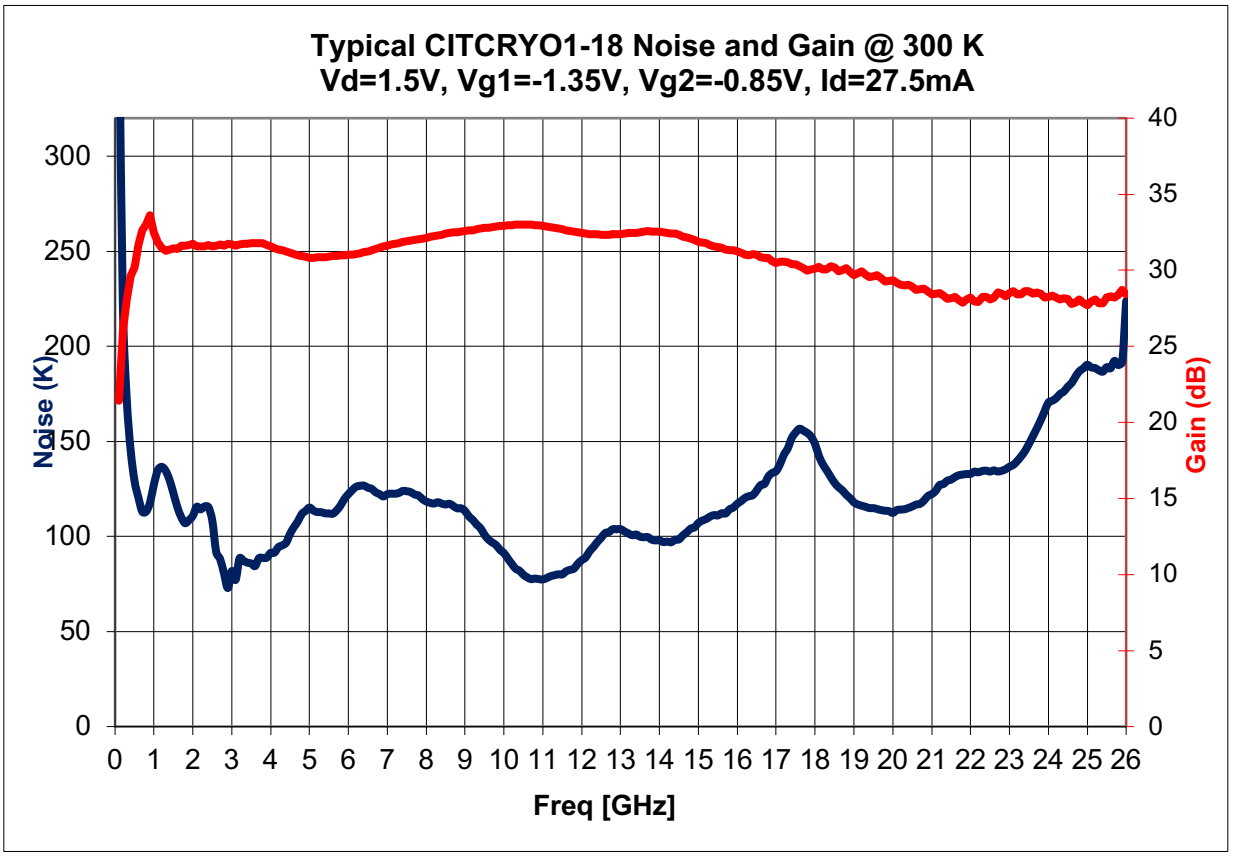
Typical Test Results – Gain Compression, P1dB
Vd=1.2V, Tc=12K



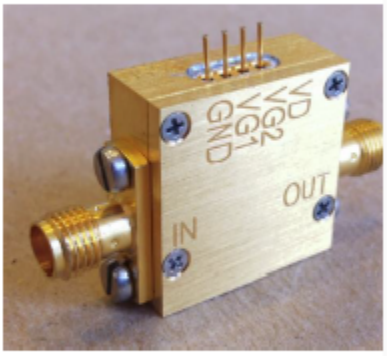


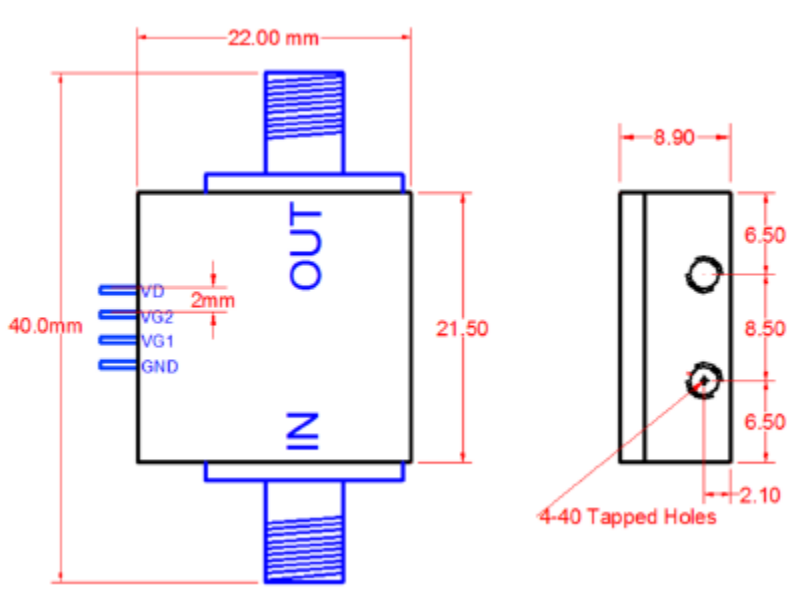


Typical Test Results – Optimum DC Bias @ 300 K



CAD Housing Drawing





*Dimensions are in mm

Optional Input Bias Tee

As an option, the amplifier can be supplied with a DC bias tee for an external device connected to the amplifier input. The bias tee is formed by two (2) resistors connected to the input; as shown in Figure 1. One (1) resistor can be used as a source of current and the other senses the voltage across the external device. Voltages applied to the bias tee have a small effect on amplifier operation. At 12 K, 20 KΩ resistors increase noise by 0.5 K.

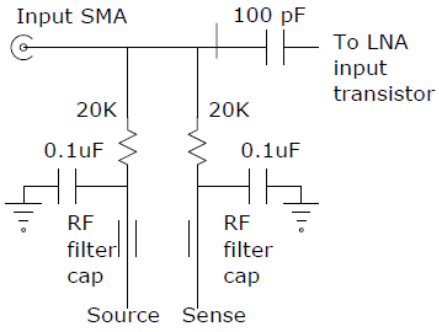
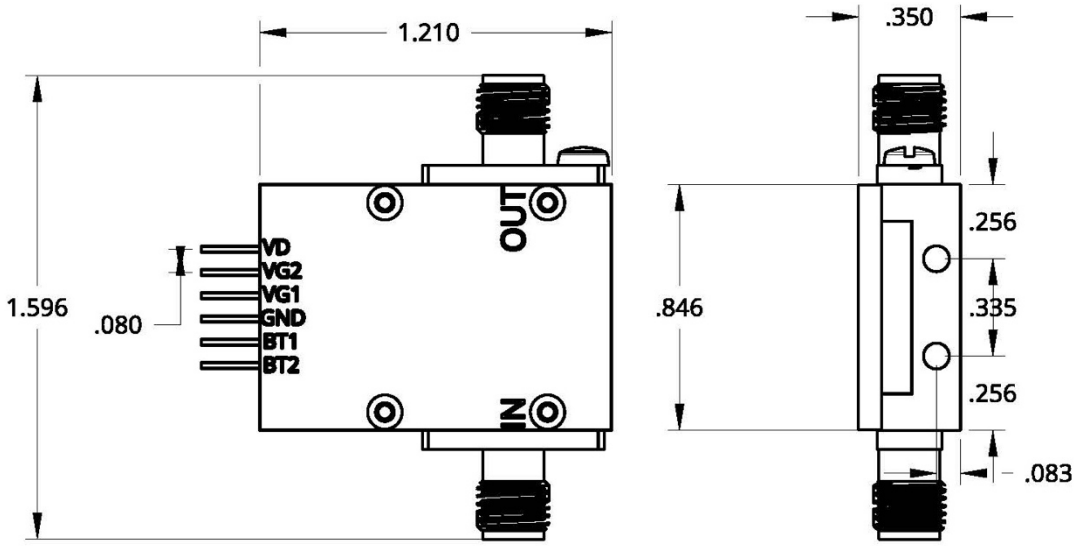


Figure 1. Bias Tee Schematic



Optional Input Protection Diodes

As an option, the amplifier can be supplied with ESD protection & voltage spike protection at the RF input to the amplifier. There will be a slight degradation of the amplifier performance. Please note that the optional input protection diodes cannot be used if DC voltages are applied to the RF line using input bias tees.

To order an amplifier with internal bias resistors, add the resistance to the part #. For instance, CITCRYO1-18-PD.

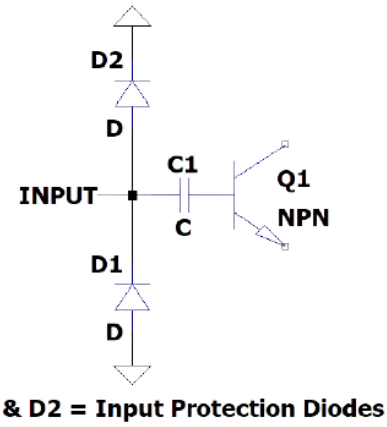


Figure 2. Protection Diodes Schematic

Product Care and Maintenance

- Use care to not bend (and break) the DC bias pin when tightening the output SMA connector.
- The amplifier should not be connected to the power supply when connecting the input connector.
- Set the power of Port 1 in your VNA to be less than -45 dB when testing the amplifier. Otherwise, the amplifier may saturate, and the data obtained will be incorrect.
- Do not attempt to open the amplifier.
- Electrostatic discharge may damage the amplifier.

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